

Serial No.: 09/990,127
Docket No.: PHUS007084US

Amendment B

RemarksClaims

Claims 1-19 are pending in the present application.

Claims 1 and 8-10 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Charles *et al.* (US 6,665,554).

Claims 2-7 and 11-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Charles *et al.*

Claims 1, 3, 5, 6, 8, and 12 have been amended.

Claims 2 and 11 have been cancelled.

Claims 4, 7, 9, 10, and 13-19 remain in the application unamended.

THE CHARLES REFERENCE

Charles *et al.* is directed to a manipulator, and particularly to a manipulator suitable for use in conjunction with medical imaging devices.

In particular, Charles *et al.* teaches that the manipulator includes an insertion mechanism which includes an upper clamp 85 capable of releasably grasping a needle 15, a guide in the form of a lower clamp 95 for guiding the needle 15 in the lengthwise direction, and an insertion axis actuator 80 for moving the upper clamp 85 in the lengthwise direction of the needle 15 to translate the needle 15 while a lower clamp 95 remains stationary with respect to the second frame 74. See, Charles *et al.*, c:8, l:10-16.

Charles *et al.* goes on to teach that the upper clamp 85 includes two stationary blocks 86 mounted on a frame 83 secured to the coil unit 82 of the linear actuator 80 and each having a recess 87 for receiving the needle 15. Another block 88 also having a recess 89 for receiving the needle 15 is supported for movement towards and away from the stationary blocks 86 in a direction transverse, e.g., perpendicular to the axis of the needle 15. The movable block 88 can be moved by any suitable actuator. Rotation of a motor 90 in one direction moves the movable block 88 towards the stationary blocks 86 to grasp the needle 15, while rotation of the motor 90 in the opposite direction moves the movable block 88 away from the stationary blocks 86 and from the needle 15 to release the needle 15. See, Charles *et al.*, c:8, l:49 - c:9, l:11.

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Further, Charles *et al.* teaches that the recesses in the blocks can have any shapes which enable the blocks to grasp the needle 15. In the illustrated embodiment, the recesses are V-shaped notches which form tangential contact with the outer surface of the needle 15. Alternatively, the recesses may have a shape, such as arcuate, similar to the shape of the outer surface of the needle 15, or the recesses may be lined with a resilient material which can conform to the shape of the needle 15.

THE PRESENT APPLICATION

The present application discloses an end-effector 66 shown generally in FIGS. 3A, 3B, and 3C. The end-effector includes a base 68 which is attached to the end-effector joint 64. A pneumatic gripper 70 is attached to base 68. The gripper includes a rail 74 upon which grip carriers 76, 78 can be translated toward and away from one another using compressed air, the application of which is controlled by the controller 72. Thus, in the embodiment shown, the grip carriers 76, 78 are movable the direction marked X.

Turning to FIG. 4, fingers of the end effector 66 are shown in an open position. The fingers 90, 92 each include a first surface 100 which, in operation, faces towards the patient and a second surface 102 which faces away from the patient. Gripping surfaces 104, 106 are located at the distal end of the fingers 90, 92 respectively so as to face each other.

In addition to the gripping surfaces 104, 106, substantially v-shaped instrument guides 110, 112 are disposed at the distal end of the fingers 90, 92, respectively.

With reference to FIG. 5, each instrument guide 110, 112 includes a body portion 114 which is attached to a given finger 90, 92, and two prongs 120, 122 which extend past the gripping surface 104, 106 of each finger a distance L. The prongs are arranged such that an angle Z is formed between the prongs. The distance L and angle Z are selected such that various sized instruments can be gripped and stabilized by the end effector 66. It is therefore advantageous that the instrument guides 110, 112 are removeably fastened to the fingers 90, 92 so that variously dimensioned instrument guides can be attached to the fingers.

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As shown in FIG. 6, in the case where the surgical instrument is a biopsy needle, the instrument 130 is located between the gripping surfaces 104, 106 of the fingers. The grip pressure exerted on the instrument 130 by the gripping surfaces 104, 106 is controlled by the controller 72 to prevent or allow relative motion between the needle and fingers as desired. In addition, the instrument 130 passes through the prongs 120, 122 of the instrument guides 110, 112. The prongs provide stability to the instrument and prevent the instrument from rotating away from the desired trajectory line. Additionally, the extension L of the prongs and the angle Z defined therebetween are selected to allow the grip surfaces to contact and grip the instrument while the prongs stabilize the instrument.

Once the mechanical arm 30 has been positioned in the desired location with respect to the patient and the instrument 130 has been secured between the gripping fingers 90, 92, the instrument can be inserted into the patient.

THE CLAIMS DISTINGUISH PATENTABLY AND NON-OBVIOUSLY OVER THE PRIOR ART OF RECORD

Claim 1 has been amended to include the limitations of claim 2. Claim 1, as amended is directed to A medical imaging system for conducting an image-guided medical procedure on a subject, the system comprising: a medical imaging apparatus for obtaining volumetric images of the subject; means for planning an interventional procedure on a subject using the volumetric images; a mechanical arm assembly disposed in proximity to the medical imaging apparatus, the mechanical arm assembly comprising a base support, a distal end, a plurality of arm segments, and a plurality of joints between the arm segments for carrying out the interventional procedure; and an end-effector disposed at the distal end of the mechanical arm assembly, the end-effector comprising gripping means for selectively gripping a surgical instrument during the interventional procedure with a gripping force ranging from zero to a force which prevents relative movement between the gripping means and the surgical instrument wherein the end-effector further comprises: a first finger portion having a first gripping surface; a second finger portion having a second gripping surface, the first and second gripping surfaces being opposed to one another for applying a gripping force to the surgical instrument; a first surgical instrument guide disposed on the first finger portion and extending towards the second finger portion; and a second

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surgical instrument guide disposed on the second finger portion and extending towards the first finger portion.

Applicants respectfully assert that the Office Action has not established a *prima facie* case of obviousness with respect to claim 1 which now includes the limitations of claim 2.

Applicants respectfully submit that it is the duty of the examiner to establish some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. See, MPEP § 2143. In rejecting claim 2, the Office Action states that it would have been an obvious matter of design choice to a person of ordinary skill in the art to use clamps composed of opposed finger portions because Applicant has not disclosed that finger portions provide an advantage, are used for a particular purpose, or solve a stated problem.

The Office Action goes on to state that one of ordinary skill in the art would have expected Applicants' invention to perform equally well with the opposed block portions of Charles *et al.* or the claimed finger portions because both perform the same function of grasping and stabilizing the medical instrument. Again, such a statement is unsupported by the Office Action. Further, such a statement relies on impermissible hindsight.

Notwithstanding the foregoing, Applicants respectfully submit that, as noted above, with reference to FIG. 5 of the present application, each instrument guide 110, 112 includes a body portion 114 which is attached to a given finger 90, 92, and two prongs 120, 122 which extend past the gripping surface 104, 106 of each finger a distance L. The prongs are arranged such that an angle Z is formed between the prongs. The distance L and angle Z are selected such that various sized instruments can be gripped and stabilized by the end effector 66. It is therefore advantageous that the instrument guides 110, 112 are removeably fastened to the fingers 90, 92 so that variously dimensioned instrument guides can be attached to the fingers. Accordingly, Applicants respectfully submit that the present design is advantageous over Charles *et al.*

In light of the foregoing, the Office Action has not established why it would have been an obvious matter of design choice to modify the Charles *et al.* reference to

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include an end-effector having a first finger portion having a first gripping surface; a second finger portion having a second gripping surface, the first and second gripping surfaces being opposed to one another for applying a gripping force to the surgical instrument; a first surgical instrument guide disposed on the first finger portion and extending towards the second finger portion; and a second surgical instrument guide disposed on the second finger portion and extending towards the first finger portion as set forth in claim 1. Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

Claims 3-7 depend from claim 1. For at least the reasons set forth above in connection with the patentability of claim 1, Applicants submit that claims 3 and 4 are patentable over the prior art of record.

Claim 8 has been amended to include the limitations of claim 11. Claim 8, as amended is directed to a method of conducting an image-guided medical procedure on a subject, the method comprising: generating at least one volumetric image of the subject; planning an interventional procedure on the subject using the at least one volumetric image; gripping a surgical instrument with an end-effector, the end-effector being disposed at a distal end of a mechanical arm assembly; moving the surgical instrument into the subject along a trajectory in accordance with the planned interventional procedure using the mechanical arm assembly; and releasing the surgical instrument wherein the step of gripping comprises the steps of: applying a gripping force to the surgical instrument using a first gripping surface disposed on a first finger portion of the end-effector and a second gripping surface disposed on a second finger portion of the end-effector; and stabilizing the surgical instrument using a first instrument guide disposed on the first finger portion and a second instrument guide disposed on the second finger portion.

The reasons set forth above in connection with the patentability of claim 1 can be applied analogously to claim 8. Accordingly, Applicants submit that claim 8 is patentable over the prior art of record.

Claims 9-10 and 12-13 depend from claim 8. For at least the reasons set forth above in connection with the patentability of claim 8, Applicants submit that these claims are patentable over the prior art of record.

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Claim 14 is directed to a medical imaging system comprising: imaging means for generating at least one volumetric image of a subject; planning means for planning an interventional procedure on the subject; a mechanical arm assembly disposed in proximity to the imaging means, the mechanical arm assembly comprising a base support, a plurality of arm segments, a plurality of joints, and a distal end; an end-effector disposed at the distal end of the mechanical arm assembly, the end-effector comprising: a first finger portion having a first gripping surface; a second finger portion having a second gripping surface, the first and second gripping surfaces being opposed to one another for applying a gripping force to a surgical instrument; a first surgical instrument guide disposed on the first finger portion and extending perpendicularly to the first gripping surface; and a second surgical instrument guide disposed on the second finger portion and extending perpendicularly to the second gripping surface.

The reasons set forth above in connection with the patentability of claim 1 can be applied analogously to claim 14. Accordingly, Applicants submit that claim 14 is patentable over the prior art of record.

Claims 15-18 depend from claim 14. For at least the reasons set forth above in connection with the patentability of claim 14, Applicants submit that claims 15-18 are patentable over the prior art of record.

Claim 19 is directed to a medical imaging system according to claim 14 wherein the first surgical instrument guide comprises a first and second prong, the first and second prongs extending past the first gripping surface and the second surgical instrument guide comprises a third and fourth prong, the third and fourth prongs extending past the second gripping surface.

As noted above, Charles *et al.* teaches that the recesses in the blocks can have any shapes which enable the blocks to grasp the needle 15. In the illustrated embodiment, the recesses are V-shaped notches which form tangential contact with the outer surface of the needle 15. Alternatively, the recesses may have a shape, such as arcuate, similar to the shape of the outer surface of the needle 15, or the recesses may be lined with a resilient material which can conform to the shape of the needle 15. Accordingly, the notches (gripping surfaces) and corresponding end portions/prongs for stabilizing the instrument identified by the Office Action are one

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in the same. Accordingly, Charles *et al.* does not teach or suggest that the first and second prongs extend past the first gripping surface and that the third and fourth prongs extend past the second gripping surface as set forth in claim 19.

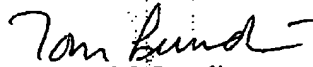
In light of the foregoing, Applicants respectfully submit that the prior art reference does not teach or suggest all the claim limitations of claim 19. Accordingly, Applicants respectfully request reconsideration and withdrawn of the rejection of claim 19.

Conclusion

It is submitted that claims 1-19 distinguish patentably and non-obviously over the prior art of record and are in condition for allowance. An early indication of allowability is earnestly solicited.

If any extension of time or any fees are required relative to this Response, Applicants hereby petition for such extension and provide the authorization to charge deposit account 14-1270 for any necessary fees.

Respectfully submitted,



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